

NOTES ON AUSTRALIAN MARINE ALGAE. v.

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(Plates xli-xlviii.)

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1. *Algae collected at Michaelmas Cay, 27 miles off Cairns, Qld., by T. Iredale and G. P. Whitley in June, 1926.*

Under the auspices of the Great Barrier Reef Committee a bore was put down in Michaelmas Cay, a narrow sandbank lying 27 miles off Cairns. The Cay is about 300 yards long and runs from N.E. to S.W. and is quite low. Rough accommodation was provided on the Cay for the workmen and naturalists. Messrs. Iredale and Whitley spent a month there engaged in the study of the fauna of the reefs and in collecting zoological specimens for the Australian Museum, Sydney. At my request they kindly undertook to gather the algae as well.

The prevalent winds blow from the S.E. On that side corals flourish, but algae cannot obtain a foothold on the living coral. On the N.W. are dead corals in abundance, and the weeds grow freely on the blocks, from sea level to a depth of some two fathoms at least.

A first and larger collection was unfortunately swept away by an unusually high and unexpected tide, and lost. A second collection included the following species:

CHLOROPHYCEAE.

- Boodlea coacta* (Dickie) Murray. New for Australia.
- Dictyosphaeria favulosa* (Mert.) Decaisne.
- Valonia Forbesii* Harv. New for Australia.
- Halimeda opuntia* (Linn.) Lamour.
- Halimeda tuna* (Ellis and Soland). Lamour.
- Caulerpa clavifera* (Turn.) J. Ag.

PHAEOPHYCEAE.

- Hydroclathrus cancellatus* Bory.

RHODOPHYCEAE.

- Gracilaria taenioides* J. Ag.
- Hypnea seticulosa* J. Ag.
- Laurencia obtusa* (Huds.) Lamour.
- Laurencia rigida* J. Ag.
- Digenea simplex* (Wulf.) J. Ag.
- Acanthophora orientalis* J. Ag.
- Levillaea jungermannioides* (Mart. and Hering) Harv.
- Ceramium clavulatum* (Mont.) J. Ag.
- Jania rubens* Lamour.

2. *Chlorophyceae* from Bowen, Port Denison.

Mr. E. H. Rainford, of Bowen, has favoured me with numerous valuable consignments of algae from that locality. He has very generously put himself to the labour of freely, carefully and judiciously collecting the seaweeds growing on the reefs of Stone Island and the shores generally of Port Denison. He has already sent some 50 species.

Sonder in his *Algen des tropischen Australiens*, 1871, recorded and described a number of forms sent to him from Port Denison by Fitzalan and Kilner. Some of these have been gathered by Mr. Rainford, and also some others not noted by Sonder. The Chlorophyceae are particularly interesting.

Boodlea coacta (Dickie) Murray was found in Australian waters for the first time around the Michaelmas Cay, as recorded above. It is evidently abundant in Port Denison.

Anadyomene Brownii (Gray) J. Ag. This was described from Port Denison as a new species under the name *A. Muelleri*, by Sonder, but he had been anticipated by Gray. Mr. Rainford sent a number of excellent specimens. The plant also occurs around Celebes.

Dictyosphaeria favulosa (Mert.) Decaisne. A fine suite of specimens. Not recorded by Sonder, but known from the Sandwich and Friendly Islands and from Ravak and north Australia. Another species, *D. sericea* Harv., is found on the south-west and southern coasts of Australia and around Tasmania. Harvey thought it might be a form of *D. favulosa* but gave it a specific name. Agardh regarded it as distinct.

Valonia confervoides Harv. A single specimen, apparently rolled into a ball by the waves, so that at first I thought I was dealing with a globular *Codium*. It has previously been recorded from Stone Island, but not by Sonder.

Caulerpa laetevirens Mont.

C. sedoides (R. Br.) J. Ag. Upright fronds 3 to 4 inches long.

C. tristicha J. Ag. The rammenta regularly tristichous, short and mucronate. Probably the form attributed to *C. cupressoides* by Sonder.

Udotea orientalis A. and E. S. Gepp. Not noted by Sonder, but recorded from Cape Flattery, Dunk Island and Port Denison (A. and E. S. Gepp, Codiaceae of the Siboga Expedition).

U. argentea Zan. Not noted by Sonder, but collected by Banfield at Dunk Island, and also sent to the British Museum from Queensland by Bailey.

One example of each of the Udoteas but in each case a fine specimen with typical frond filaments.

Neomeris dumetosa Lamour. A single frond growing on a fragment of coral, but identical in structure with specimens in the Sydney Herbarium, distributed by Harvey from the Friendly Islands. I do not know of any previous record of this plant from Australia.¹

Avrainvillea erecta (Berkeley) A. and E. S. Gepp. = *A. papuana* Murray and Boodle. A single frond, dark green, stipitate, fan shaped with finely crenulate-lacerate edges. Stipes 10 mm. long, 15 mm. wide near the base; lamina 30 mm. long, 45 mm. wide. The filaments are cylindrical and yellow by transmitted light, with a diameter of 30 to 40 μ and somewhat swollen extremities.

Known to range from Madras and Ceylon to New Guinea, but not previously recorded from Australia. (See Plate xli, fig. 3.)

¹ Since writing the above, I have received further clumps of fronds from Mr. Rainford.

An allied species, *A. clavatiramea*, has been described by A. and E. S. Gepp from plants gathered by J. Bracebridge Wilson in Corio Bay (Port Phillip) and at Port Phillip Heads.

Otherwise, the genus is not represented in Australia.

Halimeda. Mr. Rainford has forwarded four species: *H. tuna* (Ellis and Soland.) Lamour; *H. opuntia* (L.) Lamour; *H. incrassata* (Ellis) Lamour; *H. polydactylis* J. Ag.

Codium. Sonder had no *Codia* from Port Denison but two forms from Rockingham Bay, which he ascribes to *C. tomentosum*, "the smaller scarcely two inches, the larger in contrast over a foot long".

Mr. Rainford also sends me two forms from Bowen; the smaller, a little over two inches long and compressed, appears to agree in characters with *C. lineare* J. Ag., previously recorded from Port Denison and from Moreton Bay; the larger, about six inches long and terete, agrees with *C. tomentosum* (Huds.) Stackh. The utricles of both are obovate-pyriform with very thin apical membrane.

3. Two forms of *Codium*.

Mr. Rainford sent me a series of examples of a *Codium*, which has puzzled me. The first two specimens were saccate and of a very dark green, and I thought that I might be handling specimens of *C. ovale* Zan., described from New Guinea as follows:

"Fronde pumila, substipitata, obovata, intus cava, intense colorata, exsiccatione atrovirente". (De Toni, *Sylloge Algarum*, ii).

Plants sent later by Mr. Rainford were much more varied in form, some resembling the irregular dense-textured and closely adhering plants of *C. adhaerens*, which is common on our southern coasts, and others growing out into ultimately hollow lobes.

Amongst the *Codia* of the Siboga Expedition collections from the East Indian seas, A. and E. S. Gepp give *C. adhaerens*, *C. difforme* and *C. ovale*. De Toni in the *Sylloge* includes *C. difforme* Kuetz. under *C. adhaerens*. Mr. and Mrs. Gepp evidently regard *C. difforme* as a distinct form. We have no copy of Kuetzing's work in Australia, and I have had no opportunity of seeing his description. I had drawn up a description of the Bowen plant, considering it to be distinct from *C. adhaerens*, and I append the description. After reading the Siboga Monograph, however, I suspect that the plant may very well be *C. difforme*, and that it bridges the gap between *C. adhaerens* and *C. ovale*. The former grows between tides and the latter is recorded at 16 m. from North Ubian, Sulu Archipelago, and at 27 m. from Banda. (*Codiaceae of the Siboga Expedition*.)

Frons polymorpha varie lobata vel tuberiformis hinc et illinc byssis ad saxa adfixa; cutis epidermea ex ultimis utriculis parallelis constans firma, fila interiora laxa mucosa, utriculi ultimi cylindranei obtusi rarius subpyriformes, 75-108 μ lati, plerumque 350-380 μ longi; frons matura intus cava; substantia firma, fronde ad atmosphaeram exposita vel in aqua dulci immersa haud faciliter deliquescente; color obscure viridis, in sicco nigrescens. Sporangia non visa.

Habitat.—Bowen, Queensland (E. H. Rainford). (See Plate xli, figs. 1 and 2.)

I take the opportunity of describing here a form of *Codium*, which I gathered in 1909 at Caloundra, South Queensland, but which was not forwarded to me by Mr. Rainford.

CODIUM GLOBOSUM, n. sp. (Plate xli, fig. 4.)

Frons globosa solida, bysso filorum sericeorum adfixa, 10-20 mm. diametro, intus plexu filorum intricato, extus lobis periphericis inflato-cylindraccis ad superficiem frondis directis, apicibus liberis eminentibus, constans. Fila interiora circ. 30 μ lata, insuper viridia, flexuosa nunc dichotoma. Lobi terminales singulo peripherico strato appositi, circ. 3 mm. longi, 275-350 μ lati, valde obtusi, contentum viridem exhibentes, e filis singulis vel pluribus surgentes. Sporangia non visa. Color laetevirens.

Habitat.—Caloundra, S. Queensland (Lucas).

Frond globose solid, attached by a bysso of silky threads, 10-20 mm. in diameter, consisting of an inner intricate plexus of fibres, and externally of peripheric inflated-cylindrical utracles directed to the surface, the apices freely projecting. The interior fibres about 30 μ wide, flexuose and now and then dichotomous, green in their upper range. Utracles adpressed in a single peripheric stratum, about 3 mm. long and 275-350 μ broad, bluntly obtuse with a green content, arising by one or more branches from the fibres. Sporangia not seen. Colour light green.

Habitat.—Caloundra, S. Queensland (A. H. S. Lucas).

A small form having the general shape and habit of *C. bursa* and *C. mammillosum*, and apparently intermediate in characters between these two species. The main distinction lies in the dimensions of the ultimate green lobules. The diameter in the three species has the width as follows:

C. bursa from Victoria and Tasmania 120-200 μ .

C. globosum from S. Queensland 275-350 μ .

C. mammillosum from Warrnambool 600-770 μ .

The surface texture shows a corresponding difference in the three forms, close in *C. bursa*, more openly papillate in *C. globosum* and much more coarsely mammillate in *C. mammillosum*. The colour of the two latter is a brighter and lighter green than that of *C. bursa*. (See Plate xli, fig. 4.)

4. *Notes on Caulerpa.*

In the Herbarium of the Botanic Gardens, Sydney, were examples of a *Caulerpa*, which appeared to me to be *C. ligulata* Harv., recorded only from South Africa. The specimens had been obtained from the herbarium of R. Helms, and no locality was indicated. Later, however, I came across the plant growing abundantly on mud-covered rocks at Sandringham, Botany Bay; and still later I found many large plants washed up at Balmoral, Middle Harbour, Sydney. They agree well with Harvey's description, attaining a height of over a foot and forming stout clumps with matted surculi spreading over an extensive base of several square inches. The colour is a most vivid green. This is a very remarkable distribution of a *Caulerpa*, a member of a genus in which reproduction by means of spores is quite unknown, and throws an unexpected light on former land connections. (See Plate xlii.)

Mr. R. Baxter sent a large collection of Algae from Lord Howe Island to the Australian Museum, Sydney, which by the courtesy of the Director, Dr. Charles Anderson, I was enabled to examine. Amongst them were fine specimens of *Caulerpa fastigiata* Mont. This makes an addition to the Australian *Caulerpa* flora, which now includes 41 species. We may anticipate that other *Caulerpas* of the Pacific Islands will also be found on our tropical shores and reefs. (See Plate xliii, fig. 1.)

In 1909 the collections of Algae made on an extensive voyage of the Government trawler "Endeavour" were submitted to me. Mr. Charles Hedley accompanied the expedition and to his judgment and care the value of the algal collection was due. When off Kangaroo Island, a *Caulerpa*, represented by four or five specimens, was dredged in some eight fathoms of water. The plant was evidently quite new to Australia, and I proposed to describe it under the name of *C. Hedleyi* from the discoverer. To make sure that it was an altogether unknown form, I sent a specimen to Mrs. E. S. Gepp of the British Museum, who had kindly assisted me on other occasions. Mrs. Gepp forwarded it to Madame Weber van Bosse in Belgium, who was working on *Caulerpa* at the time. The latter then described the plant as new, and I am glad to say adopted the name *C. Hedleyi*.

I append the description, which was published in the *Annales de l'Institut Océanographique* (Prince de Monaco) ii, 1, pp. 1, 2, 1910, as this publication is not generally available in Australia.

CAULERPA HEDLEYI A. Weber van Bosse. (Plate xliii, fig. 2.)

Frondibus constantibus surculo repenti, squamuloso, unde truncus ramosus surgit. Squamuli identidem dichotomi, fere quadripartiti, apicibus bifurcis et mucronatis surculum cingunt ordinibus compluribus, densatis.

Truncis ramis oppositis, patentibus; truncus et rami ramulosi sunt. Ramuli identidem dichotomi sunt, adpressi, 500-600 μ longi, apicibus bifurcis et mucronatis, circum truncum et ramos verticillis irregularibus constantibus densatis positi.

Le *C. Hedleyi* ressemble par sa ramification, savoir—un axe central portant des branches opposées, distiques, très serrées—aux Caulerpes de la section des *Araucaroideae* (including the four Australian species, *C. flexilis*, *C. hypnoides*, *C. Muelleri* and *C. abies*), et par la forme des squamules et des ramules, à celles des *Bryoideae*, et dans cette section, dont les ramules entourent l'axe principal et les branches, surtout à la forme *tormentella* du *C. Webbiana* ou au *C. Pickeringii*, algues endogènes du Pacifique. (See Plate xliii, fig. 2.)

Madame van Bosse also alludes to the depth of the water in which *C. Hedleyi* was growing. Most of our Caulerpas have been gathered in rock pools and in channels through which the tides scour, but they probably extend into deeper water, and flourish there more luxuriantly. At a depth of 4-6 fathoms in Port Esperance, Tasmania, I dredged abundance of fine plants of *C. trifaria*, much larger than those in the rock pools of Port Phillip Heads, and also dredged *C. Brownii* at similar depth in the D'Entrecasteaux Channel, while Mr. L. Rodway dredged *C. cactoides* at 20 fm. near Actaeon Island.

Edible Green Algae. In a collection forwarded by my friend, Dr. Olive Wood, from Nukualofa, Tonga, were three plants, which she informs me are eaten by the natives, *Caulerpa clavifera*, *Codium tomentosum* and *C. difforme*. Of the first Dr. Wood writes: "No. 1 is a great delicacy, and especially appeals to the palate of women during pregnancy, who frequently leave their homes inland, and live with relatives in a seaside village, so as to be near the source of supply".

Miss Minnie Reed in a paper on "The Economic Seaweeds of Hawaii and their Food Value", published in the *Annual Report of the Hawaii Agricultural Experiment Station*, 1906, states that there are over 70 distinct species of algae used for food by the Hawaiians. Two of these are *Codium adhaerens* and *C. tomentosum*.

5. *Fucoideae. Distribution Notes.*

In Notes on Australian Marine Algae, i (Proc. LINN. Soc. N.S.W., 1913, xxxviii, p. 51) I recorded *Hormosira articulata* (Forsk.) Zan. from Port Stephens, and ventured to predict its occurrence further north. Since that time, 1913, I have received specimens from New Caledonia (C. Dézarnaulds), and now from Bowen, Port Denison (E. H. Rainford). (See Plate xliv.)

In the same paper I suggested that the *Haliseris* of N.E. Queensland was probably not *H. Muelleri* but *H. acrostichoides*. Mr. Rainford has sent me typical plants of *H. acrostichoides* from Bowen. Mr. H. A. Longman sent me specimens from Noosa Hd., and I gathered it at Sandgate, Moreton Bay, so that this seems to be the commonly occurring *Haliseris* of the east coast of Australia.

J. G. Agardh, *Spec. Sargass. Australiae*, gives the range of *Sargassum cristatum* J. Ag. as southern coasts of Australia (F. von Mueller, Watts, Collie). The Mesdames Harrison and Waterhouse gathered most characteristic fruiting specimens on the beach at Geraldton, W.A.

Sargassum verruculosum (Mert.) J. Ag. appears to be very shy of fruiting. Acres of the bottom of many Tasmanian harbours and estuaries are covered with this plant but I never found a specimen in fruit.

It is very noteworthy that the Sargassa met with round the coasts of Tasmania are almost or quite confined to the subgenera *Phyllotricha* and *Arthrophyucus*, while the species of *Eusargassum* abound in the warmer seas of Western and North-eastern Australia.

6. *Two New Species of Chondria.*

Chondria is well represented in Australian seas. De Toni lists 11 species. Certain of these seem to be very close counterparts of European and West Indian species. Thus Harvey distributed Australian forms under the names of *C. dasyphylla*, *C. sedifolia* and *C. tenuissima* (?). By later writers these identifications have not been accepted.

In the present paper I venture to add two new species, one from Bowen closely allied to *C. tenuissima*, and the other from N. S. Wales closely allied to *C. caeruleascens*. The former belongs to the section *Euchondria*, with the punctum vegetationis freely produced at the tip of attenuate segments and the latter to the section *Coelochondria*, with the punctum vegetationis immersed in a pit at the apex of the blunt segments.

CHONDRIA RAINFORDI, n. sp. (Plate xlv, Plate xlvii, fig. 2.)

Frons robusta, plexu fibroso radicata caespitosa, pedalis et ultra, alterne decomposito-pinnata; caulis teres vix compressus, a basi tenui gradatim superne incrassatus, regione media pennam columbae crassitie aequans; rami alterni ad 20 uncias longi, 12-25 mm. distantils quoquoversum egredientes, ambitu lanceolati vel fere lineares; rami ramulique (pinnae) utrinque conspicue attenuati; pinnae superne bi- vel tripinnata copiosas pinnellas fere ad instar scoparum gerentes; pinnellae lineares utriusque attenuatae, 4-7 mm. longae, longitudine 10-20 es latitudinem excellente.

Substantia mollissima mucosa unde frons ad chartam tenacissime adhaeret. Color purpurascens.

Cystocarpia subsessilia fructus Punicae-granati facies referentia, in parvis inferioribus ramis modo inevolutis sedentia, sporas magnas pyriformes 150 μ longas foventia.

Stichidia, ramulos ultimos pinnellae constituentia, sterilibus ramellis omnino similia, vix torulosa nec tumida, sporangia supra mediam partem sparsa triangule divisa gerentia.

Antheridia nondum visa.

Habitat.—Bowen, Queensland.

Frond robust, caespitose, attached by a plexus of fibres, a foot or more high, alternately decompositum-pinnate; stem round, scarcely compressed, from a slender base gradually thickened upwards, in the median region equalling a pigeon's plume in thickness; branches alternate, to 20 inches long, emerging in all directions at intervals of 12-25 mm., lanceolate or almost linear in outline; branches and branchlets (pinnae) conspicuously attenuated at both extremities; pinnae bearing in their distal part copious bi-tripinnate almost brush-like pinnellae; pinnellae linear attenuate at both extremities 4-7 mm. long, the length exceeding ten times the breadth.

Substance very soft mucous so that the frond adheres most closely to the paper.

Colour purpurascens.

Cystocarps subsessile like tiny pomegranates seated on small lower not greatly developed branches, forming large pyriform spores 150 μ long.

Stichidia consisting in the ultimate divisions of a pinnella, altogether resembling the sterile divisions, scarcely swollen or torulose, bearing triangularly divided sporangia dispersed above the middle of the stichidium.

Antheridia not seen.

Habitat.—Bowen, Queensland.

I dedicate this elegant *Chondria* to Mr. E. H. Rainford, of Bowen, who gathered a fine sequence of specimens and mounted them while fresh. I am greatly indebted to Mr. Rainford for excellent collections of algae from Port Denison.

This is probably the plant recorded from Port Denison by Sonder under the name *C. tenuissima* J. Ag. He states that the plants were 1-1½ feet high (*Die Algen des tropischen Australiens*, p. 51).

By way of comparison I give photographs of *C. fusifolia* H. and H., which I gathered in the Tamar and in the Derwent. The plants are crowded with tetrasporangia, but I have not found any bearing cystocarps. (Plate xlvi, Plate xvii, fig. 1.)

CHONDRIA IRIDESCENS, n. sp. (Plate xlviii.)

Frons teres, plexu fibroso radicata, pyramidatim decomposito-pinnata, ad 25 cm. alta; rami copiosi, distantibus 5-10 mm. orti, quoquoversum vagi, ad 15 cm. longi, pyramidatim evoluti, apices versus acuminati; ramuli crebrissimi, alterni, quoquoversum crescentes, distantibus 3-4 mm. egredientes, plures aequaliter ad 12 mm. longi, ramellos pinnatim gerentes; ramelli cylindracei, ad 2 mm. longi, fovea apicali obtusi. Rachides flexuosae. Substantia gelatinoso-carnea ergo plantu chartae tenacius adhaeret. Color obscure purpureus, in vivo pulchre coeruleo-iridescens.

Cystocarpia, *Antheridia*, nondum visa.

Stichidia ramellis conformia, subtorulosa, sporangia praecipue supra medium foveantia triangule divisa.

Sub lente cellulae superficiales ramellorum diametro aequales, ramulorum et ramorum plures longiores apparent.

Habitat.—N. S. Wales (Port Hacking, Botany Bay, Port Stephens).

FronD round, attached by a fibrous plexus, pyramidate decomposed pinnate, to 25 cm. high, branches copious, at distances of 5-10 mm., spreading in all directions, pyramidate, acuminate towards the apices; secondary branches crowded, alternate, at distances 3-4 mm., growing out in all directions, the greater part of the middle ones equal, to 12 mm. long, bearing ramelli pinnately; ramelli cylindrical to 2 mm. long, obtuse with terminal hollow pit. Rachides flexuose.

Substance gelatinous fleshy so that the plant very closely adheres to paper.

Colour dark purple, when growing beautifully bluish iridescent.

Cystocarps and *Antheridia* not seen.

Stichidia quite like the sterile ramelli, subtorulose, bearing triangularly divided sporangia chiefly above the middle.

Under the microscope the superficial cells of the ramelli are as broad as long, those of the ramuli and rami many times as long as broad.

Habitat.—N. S. Wales (Port Hacking, Botany Bay, Port Stephens).

This form is clearly very nearly related to *C. coeruleescens* but of larger dimensions. I examined specimens of *C. curdieana* Harv. in the Melbourne Herbarium but the aspect of these was quite unlike that of the N.S.W. plants.

EXPLANATION OF PLATES XLI-XLVIII.

Plate xli.

- 1 and 2. Forms of *Codium difforme?* Bowen, Qld. (Rainford.)
3. *Avrainvillea erecta* = *A. papuana*. Bowen. (Rainford.)
4. *Codium globosum*, n. sp. Caloundra, Qld. (Lucas.)

Plate xlii.

Caulerpa ligulata. Balmoral, Middle Harbour, Port Jackson. (Lucas.)

Plate xliii.

1. *Caulerpa fastigiata*. Lord Howe Is. (R. Baxter.)
2. *Caulerpa Hedleyi*. Kangaroo Is. (C. Hedley.)

Plate xliv.

Hormosira articulata. Bowen, Qld. (Lucas.)

Plate xlv.

Chondria Rainfordi, n. sp. Bowen. (Rainford.)

Plate xlvi.

Chondria fusifolia. R. Tamar. Tas. (Lucas.)

Plate xlvii.

1. *Chondria fusifolia*. R. Derwent, Tas. (Lucas.)
2. *Chondria Rainfordi*, n. sp. Base. Bowen (Rainford.)

Plate xlviii.

Chondria iridescens, n. sp. Port Hacking, N.S.W. (Kretschman.)